

**REMARKS**

With the entry of this Response, Claims 1-24 are pending. Claims 17-24 have been withdrawn. Therefore, Claims 1-16 are under consideration. Claims 1, 3, 11, and 16 are amended herein. Claim 1 is currently amended to recite “wherein the presence or absence of said one or more thermophilic or extremophilic microorganisms indicates (1) the presence or absence of a hydrocarbon zone or (2) the properties of the hydrocarbon zone; wherein comparison of the properties of the hydrocarbon zone in the sample relative to the properties of the hydrocarbon zone in prior or subsequent samples identifies changes in the hydrocarbon zone.” The support for currently amended Claim 1 is found throughout the specification and at least on page 5, line 7 through page 6, line 30 where detection, characterization, and monitoring of hydrocarbon zones is discussed. Claim 3 is amended to address a grammatical error noted by the Office Action. Claim 11 is amended to recite “wherein nucleic acid from or derived from the thermophilic or extremophilic microorganisms within the sample is amplified.” Support for the amendment to Claim 11 can be found at least on page 12, line 33 through page 14, line 17, where the amplification of nucleic acid from thermophilic or extremophilic microorganisms within the sample is discussed. Claim 16 is amended to recite “wherein at least one probe is SEQ ID NO: 1.” Support for the amendment to Claim 16 can be found throughout the specification, and at least on page 31, lines 14-18, where combinations of probes including SEQ ID NO. 1 are discussed. Applicants do not believe that these amendments raise new issues or constitute new matter.

**CLAIM OBJECTIONS**

The Office Action objected to Claim 3 because “claim 3 recites the phrase ‘a oil/water mixture’ where the phrase ‘an oil/water mixture’ is appropriate.” (Office Action, p. 2). Applicants thank the Examiner for drawing Applicants’ attention to this grammatical oversight. Applicants have amended Claim 3 to correct the grammatical error. In light of the amendment to Claim 3, Applicants believe the objection has been overcome. Therefore, Applicants respectfully request the withdrawal of the objection of Claim 3.

The Office Action objected to Claim 16 over the recitation of non-elected subject matter in the alternative. (Office Action, p. 2). Specifically, the Office Action states that Claim 16

encompasses any combination of SEQ ID NOs.: 1-16 including combinations that exclude the elected SEQ ID NO: 1. Applicants have amended Claim 16 to recite “wherein at least one probe is SEQ ID No. 1.” Applicants believe that currently amended Claim 16 overcomes the objection. Therefore, Applicants respectfully request the withdrawal of this objection of Claim 16.

**REJECTIONS UNDER 35 U.S.C. § 112, SECOND PARAGRAPH**

The Office Action rejects Claims 1-11, 15, and 16 under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter that Applicants regard as the invention. Applicants respectfully traverse this rejection.

Regarding these rejections, the Office Action more specifically states that “Claims 1-11, 15 and 16 are unclear over the stated purpose of the claimed methods of ‘detecting, characterizing or monitoring a hydrocarbon zone’, as recited in the preamble of claim 1.” To this end, the Office Action states that “a ‘genotypic analysis’ does not *a priori* result in detecting, characterizing or monitoring,” and that the method step of independent Claim 1 and the purpose stated in the preamble allegedly lack a nexus. Lastly, the Office Action explains that “it is not clear how the purpose of the method is accomplished.” (Office Action, p. 3).

Currently amended Claim 1 recites a method of detecting, characterizing, or monitoring a hydrocarbon zone comprising performing the genotypic analysis of a sample for detecting the presence or absence of one or more thermophilic or extremophilic microorganisms, wherein the presence or absence of said one or more thermophilic or extremophilic microorganisms indicates (1) the presence or absence of a hydrocarbon zone or (2) the properties of the hydrocarbon zone; wherein comparison of the properties of the hydrocarbon zone in the sample relative to the properties of the hydrocarbon zone in prior or subsequent samples identifies changes in the hydrocarbon zone.

Applicants believe that currently amended Claim 1 establishes a nexus between the stated purpose of Claim 1 and the steps of the recited method. Therefore, Applicants respectfully request that the Examiner withdraw the rejection for independent Claim 1. As Claims 2-11, 15, and 16 all depend from Claim 1, and therefore, encompass all elements of Claim 1, Applicants respectfully request the withdrawal of this rejection of these dependent claims.

The Office Action notes that Claim 11 “is unclear over the recitation of the limitation ‘the nucleic acid within the sample’” in that “there is not proper antecedent basis for any ‘nucleic acid within the sample’ in either claim 11, or claim 1 . . . .” (Office Action, pp. 3-4). Claim 11 is currently amended to recite “wherein nucleic acid from or derived from the thermophilic or extremophilic microorganisms within the sample is amplified.” Applicants believe that amended Claim 11 has proper antecedent basis for all terms in the claim. Applicants respectfully request the withdrawal of this rejection.

**REJECTIONS UNDER 35 U.S.C. § 102**

The Office Action rejects Claims 1-12 and 15 under 35 U.S.C. § 102(b) as being anticipated by Orphan *et al.*, “Culture-Dependent and Culture-Independent Characterization of Microbial Assemblages Associated with High-Temperature Petroleum Reservoirs,” *Appl. Environ. Microbiol.*, 66(2): 700-711 (2000) (“Orphan”). Applicants respectfully traverse this rejection.

Applicants note that a “claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.” (M.P.E.P. § 2131 quoting *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631 (Fed. Cir. 1987)).

As an initial point, Applicants respectfully note that Claim 1 recites “a method of detecting, characterizing, or monitoring a hydrocarbon zone.” Applicants’ current claims are drawn to hydrocarbon zones, not to microorganisms. This is in contrast to Orphan, which focuses on characterization of microorganisms rather than characterization of hydrocarbon zones. For example, Orphan explains that “results from this study revealed diverse assemblages of thermophilic and mesophilic microorganisms, many of which are closely related to thermophilic strains culture from both the Monterey and other high-temperature oil-bearing formations.” (See p. 701, col. 1, paragraph 1). However, Orphan only shows that microorganisms are present in samples of formation waters (See Table 1) and that there were phylogenetic relationships between certain microorganisms (See Figures 1-3).

Orphan fails to teach how the absence or presence of microorganisms in a sample is indicative of (1) a prospective hydrocarbon zone or (2) the properties of that hydrocarbon zone.

As defined by the Specification, these properties include oil, quantity of oil, the quality of the oil, the sulphur or iron oxide content of the oil, the presence of gas, or the gas:oil ratio. (See paragraph 0021). Because Orphan fails to teach this, Orphan necessarily fails to monitor a hydrocarbon zone, which requires at least the characterizing of a hydrocarbon zone over time.

For at least these reasons, Applicants respectfully submit that Orphan fails to teach all of the elements of Applicants' currently amended Claim 1. As Orphan fails to teach all of the elements of Claim 1, Orphan fails to anticipate Claim 1 as presently amended. Moreover, as Claims 2-12 and 15 depend from Claim 1, Orphan also fails to anticipate dependent Claims 2-12. Applicants respectfully request the withdrawal of this rejection.

**REJECTIONS UNDER 35 U.S.C. § 103**

**A. ORPHAN IN VIEW OF BLUME ET AL.**

Claim 13 is rejected under 35 U.S.C. § 103 as allegedly being obvious over Orphan in view of Blume *et al.*, "Surface and subsurface microbial biomass, community structure and metabolic activity as a function of soil depth and season," *Appl. Soil Ecology*, 20: 171-181 (2002) ("Blume"). Applicants respectfully traverse this rejection.

In *KSR Int'l Co. v. Teleflex, Inc.* ruling, the Supreme Court has reaffirmed the *Graham* factors for determination of obvious under 35 U.S.C. 103(a). *KSR Int'l Co. v. Teleflex, Inc.* (*KSR*), No 04-1350 (U.S. Apr. 30, 2007). The three factual inquiries under *Graham* require examination of: (1) the scope and content of the prior art; (2) the differences between the prior art and the claims at issue; (3) the level of ordinary skill in the pertinent art. *Graham v. John Deere*, 383 U.S. 1, 17-18 (1966) (*Graham*). Additionally, the court in *Graham* explained that a fourth consideration for the determination of obviousness would be any objective evidence of secondary considerations. These secondary considerations included unexpected results, unmet need in the art, and commercial success. Furthermore, in order to establish a *prima facie* case of obviousness, the Examiner has the initial burden of supporting the conclusion of non-obviousness. In particular, the Examiner has the initial burden of ascertaining the differences between the claims and the prior art, which requires interpreting both the art and the claims as a whole. Stated differently, "all words in a claim must be considered in judging the patentability of that claim against the prior art." *In re Wilson*, 424 F.2d 1382, 1385 (C.C.P.A. 1970).

The Office Action states that Orphan *et al.* teaches (1) “a genotypic analysis of a sample and detecting the presence of thermophilic microorganisms,” and (2) “the analysis of samples originating from different oil reservoirs with different depths and the detection of different microorganisms in the different samples (e.g. Table 1).” (Office Action, p. 7). The Office Action admits that Orphan *et al.* fails to “specifically teach that different microorganisms are indicative of certain depths.” (Office Action, p. 7).

Applicants submit that Orphan may teach detection of microorganisms in several samples, but provides no teaching or suggestion that the microorganisms are related to a specific hydrocarbon zone. Orphan fails to teach or suggest how the absence or presence of microorganisms in a sample is indicative of (1) a prospective hydrocarbon zone or (2) the properties of that hydrocarbon zone. Orphan fails teach or suggest monitoring a hydrocarbon zone, which requires at least the characterizing of a hydrocarbon zone over time. Orphan fails to teach or suggest that particular microorganism profiles are indicative of particular hydrocarbon zones, and thus cannot provide a teaching or suggestion of Applicants’ currently pending claims.

The Office Action states that Blume teaches the analysis of microbial community structure as a function of sample depth. (Office Action, p.7). The Office Action states that it would have been prima facie obvious “to have performed an association analysis between detected microorganisms and depth, as taught by Blume *et al.*, in the analysis of microorganisms detected in oil reservoir production fluids as performed by Orphan *et al.* One would have bee[n] motivated to perform an association analysis between detected microorganisms and depth based on the teaching of Orphan *et al.* that different types of organisms are identified in samples originating from sources from different depths (Table 1).” (Office Action, p. 7).

Applicants submit that Blume teaches determining changes in microbial populations in different seasons. For example, Blume teaches the collection of soil samples in February and July.(See § 2.1 Soil Sampling and Characterization). Blue noted differences in low temperature samples and high temperature samples. Blume fails to teach or suggest how the absence or presence of microorganisms in a sample is indicative of (1) a prospective hydrocarbon zone or (2) the properties of that hydrocarbon zone. Because Blume fails to teach or suggest this, Blume necessarily fails to monitor a hydrocarbon zone, which requires at least the characterizing of a

hydrocarbon zone over time.

Applicants note that in light of these teachings, the combination of Orphan and Blume would suggest to one of skill in the art to examine the microbial population of samples at different times of the year. Whether considered individually or in combination, Orphan and Blume fail to teach or suggest the elements of Applicants' currently pending Claim 13, and therefore, fail to render obvious Claim 13. Applicants respectfully request the withdrawal of this rejection.

**B. ORPHAN IN VIEW OF RAWAT ET AL.**

Claim 14 is rejected under 35 U.S.C. § 103(a) as allegedly being obvious over Orphan in view of Rawat *et al.*, "Geo-Microbial Exploration for Hydrocarbon – A Promising Technique," *Appl. Environ. Microbiol.*, 3: 297-200 (1994) ("Rawat"). Applicants respectfully traverse this rejection.

The Office Action states that Orphan *et al.* teaches (1) "a genotypic analysis of a sample and detecting the presence of thermophilic microorganisms," and (2) "the analysis of samples originating from different oil reservoirs with different depths and the detection of different microorganisms in the different samples (e.g. Table 1)." (Office Action, p. 8). The Office Action admits that Orphan *et al.* fails to "specifically teach that the migration route of a hydrocarbon zone is determined." (Office Action, p. 8).

Applicants submit that Orphan may teach detection of microorganisms in several samples, but provides no teaching or suggestion that the microorganisms are related to a specific hydrocarbon zone. Orphan fails to teach or suggest how the absence or presence of microorganisms in a sample is indicative of (1) a prospective hydrocarbon zone or (2) the properties of that hydrocarbon zone. Orphan fails teach or suggest monitoring a hydrocarbon zone, which requires at least the characterizing of a hydrocarbon zone over time. Orphan fails to teach or suggest that particular microorganism profiles are indicative of particular hydrocarbon zones, and thus cannot provide a teaching or suggestion of Applicants' currently pending claims.

The Office Action states that Rawat *et al.* "teaches [that] geo-microbial methods may be used for the exploration of hydrocarbons." (Office Action, p. 8). The Office Action states that it would have been *prima facie* obvious "to have used the methods of Orphan *et al.* in an analysis of

hydrocarbon zone migration routes. One would have been motivated to do so based on the teachings of Rawat *et al.* that geo-microbial methods may be used to explore hydrocarbons, and the results of Orphan *et al.* that particular microorganism profiles are indicative of fluids obtained from hydrocarbon reservoirs.” (Office Action, p. 8).

Applicants respectfully submit that Rawat teaches or suggests a crude and unreliable method, which Rawat states has mixed success and requires additional development. The teachings of Rawat *et al.* are only reliable if the geology of the region is relatively uncomplex as the hydrocarbon may otherwise migrate significant distances laterally. Rawat relies solely on the phenotypic traits of the bacteria in question, i.e. their use of hydrocarbon as a substrate. This is restricting because only bacteria utilizing the disclosed substrate methane will be detected and because these bacteria may be found in areas that are not associated with hydrocarbon zones.

Rawat fails to supplement the teachings of Orphan to result in a combined teaching of Applicants’ currently amended claims. Whether considered individually or in combination, Orphan and Rawat fail to teach or suggest to one of skill in the art Applicants currently pending claims. For at least these reasons, the combination of Orphan and Rawat fail to teach or suggest currently pending Claim 14, and therefore, fail to render obvious Claim 14. Applicants respectfully the withdrawal of this rejection.

**C. ORPHAN IN VIEW OF MUYZER ET AL.**

Claim 16 is rejected under 35 U.S.C. §103 (a) as allegedly being obvious over Orphan in view of Muyzer *et al.*, “Profiling of Complex Microbial Populations by Denaturing Gradient Gel Electrophoresis Analysis of Polymerase Chain Reaction-Amplified Genes Coding for 16S rRNA,” *Appl. Environ. Microbiol.*, 59(3): 695-700 (1993) (“Muyzer”). Applicants respectfully traverse this rejection.

The Office Action states that Orphan *et al.* teaches (1) “a genotypic analysis of a sample and detecting the presence of thermophilic microorganisms,” and (2) “the analysis of samples originating from different oil reservoirs with different depths and the detection of different microorganisms in the different samples (e.g. Table 1).” (Office Action, p. 9). The Office Action admits that Orphan *et al.* fails to “specifically teach an analysis performed using SEQ ID NO: 1.” (Office Action, p. 9).

Applicants submit that Orphan may teach detection of microorganisms in several samples, but provides no teaching or suggestion that the microorganisms are related to a specific hydrocarbon zone. Orphan fails to teach or suggest how the absence or presence of microorganisms in a sample is indicative of (1) a prospective hydrocarbon zone or (2) the properties of that hydrocarbon zone. Orphan fails teach or suggest monitoring a hydrocarbon zone, which requires at least the characterizing of a hydrocarbon zone over time. Orphan fails to teach or suggest that particular microorganism profiles are indicative of particular hydrocarbon zones, and thus cannot provide a teaching or suggestion of Applicants' currently pending claims.

The Office Action states that Muyzer teaches "methods for the amplification of 16s rDNA sequences from mixed populations of microbes, including methods using a probe with the sequence set forth in SEQ ID NO: 1." (Office Action, p. 9). The Office Action states that it would have been obvious to "have used the primer according to Muyzer et al in the analysis of samples as performed by Orphan et al. Such a combination of methods would be the simple substitute by an element known in the prior art . . . ." (Office Action, p. 9).

Muyzer fails to supplement the teachings of Orphan to result in a combined teaching of Applicants' currently amended claims. Whether considered individually or in combination, Orphan and Muyzer fail to teach or suggest to one of skill in the art Applicants' currently pending claims. For at least these reasons, the combination of Orphan and Muyzer fail to teach or suggest currently pending Claim 16, and therefore, fail to render obvious Claim 16. Applicants respectfully request the withdrawal of this rejection.

#### CONCLUSION

For at least the reasons stated above, Applicants believe that the claims as amended are allowable. Applicants respectfully request that the Examiner withdraw all rejections and allow these claims.

Applicants file this response solely to facilitate prosecution. As such, Applicants reserve the right to pursue claims of broader or similar scope as originally filed in a continuation application or other application after allowance of the present application. Applicants do not concede that the current or past rejections are correct and reserve the right to challenge such rejections later in prosecution or on appeal. Accordingly, any amendment, argument, or claim



cancellation is not to be construed as abandonment or disclaimer of subject matter. Because certain of the current amendments may include broadening amendments, Applicants respectfully request the Examiner to revisit any previously reviewed references cited in this Application to further ensure that the currently pending claims remain patentable over any previously reviewed references.

If the Examiner believes there are other issues that can be resolved by a telephone interview, or that there are any informalities that remain in the application which may be corrected by the Examiner's amendment, a telephone call to the undersigned attorney at (678) 420-9428 is respectfully solicited.

Applicants enclose (1) a Request for Extension of Time (3 months) and (2) a credit card payment submitted via EFS Web in the amount of \$ 1,110.00, which pursuant to 37 C.F.R. § 1.17(a)(3) representing the large entity fee for a three-month Extension of Time. This amount is believed to be correct.

Respectfully submitted,

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